WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2004MS24B

Title: Water Quality Standards: Establishing Nutrient Criteria for Mississippi's Coastal Waters

Project Type: Research

Focus Categories: Water Quality, Nutrients

Keywords: water quality, water quality standards, coastal zone, estuaries, nutrients, eutrophication, nitrogen, phosphorus, suspended sediments, algae

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Non-Federal Matching Funds: $25,342

Congressional District: Fourth

Principal Investigator:
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Abstract

This proposal is for year two of the study and provides for: 1) evaluation of available historical data on water quality, 2) integration of current project data into the Mississippi Department of Environmental Quality (MDEQ) state database, and 3) analysis of data to aid in formulation of proposed reference conditions for Mississippi's coastal waters. Personnel will work closely with the State's Estuarine Nutrient Taskforce and the MDEQ to complete these tasks. A copy of the commitment letter from the MDEQ from the year 1 proposal is appended. Research in year 1 is providing information on nutrients and associated water column parameters during high-flow/low-flow periods as well as characterization of peak concentrations associated with the spring runoff. Monitoring included: total Kjeldahl nitrogen, ammonia nitrogen, nitrite + nitrate, total phosphate, chl a, total suspended solids, and field parameters such as dissolved oxygen, temperature, turbidity, transparency, salinity, pH, and depth. Activities focused on the water column using protocols established by MDEQ in sampling activities supporting USEPA's National Coastal Assessment (NCA) Program. Samples were analyzed according to an approved QAPP and defined QA/QC procedures. The rationale, benefits, and methodologies for this research, developed for the year 1 proposal, follow.

Nutrient overenrichment of estuaries from human-based causes is now recognized as a national problem. The National Oceanic and Atmospheric Administration's (NOAA) National Estuarine Eutrophication Assessment indicated that about 60% of the estuaries out of 138 surveyed exhibited moderate to serious overenrichment conditions. The Environmental Protection Agency (EPA) has published recommendations of water quality criteria for nutrients under section 304(a) of the Clean Water Act (66 FR 1671). States must develop water quality standards for nutrients by 2006. The EPA has proposed criteria with the intention that they serve as starting points for states to develop more refined nutrient criteria, as appropriate. States, then, have the option to develop nutrient criteria that fully reflect localized conditions and protect specific designated uses with scientifically defensible approaches as supported by EPA technical guidance manuals. To that end, the MDEQ has incorporated an aggressive monitoring and data gathering initiative into existing programs in order to provide nutrient data to support nutrient criteria development. While much has been accomplished through leveraging resources and funding from existing monitoring programs, there are still many data gaps remaining. Mississippi's estuaries are perhaps the most vulnerable and valuable of the state's waters. Coastal ecosystems form a cornerstone of the state's economy by providing a variety of valuable resources and services. Gulf of Mexico fisheries yield more finfish, shrimp, and shellfish than the South and Mid-Atlantic, Chesapeake Bay, and Great Lakes combined. Water quality and wetlands health are vital to the maintenance of fisheries production and to the other water-dependent activities that operate within the coastal zone.

Nutrient overenrichment is a common thread that ties together a diverse suite of coastal problems including harmful algal blooms (red tides), fish kills, marine mammal deaths, shellfish poisonings, loss of seagrass and bottom shellfish habitats, and hypoxia/anoxia (dead zones). Thorough assessment of coastal waters and the development of clear numerical criteria that will allow discernment of natural nutrient concentrations from heightened anthropogenic concentrations in waters where increased nutrients may cause harm to the quality and usability are critical to the evaluation and management of Mississippi's estuaries. The proposed research will provide for needed data on diel and tidal variations in nutrient concentrations and other important water quality parameters. Dissolved oxygen (DO) will be carefully monitored because adequate levels are a fundamental requirement for maintenance of populations of benthos, fish, shellfish, and other estuarine biota. Levels of dissolved oxygen are affected by environmental stresses, such as point and nonpoint discharges of nutrients or oxygen-demanding materials. In addition, stresses that occur in conjunction with low DO concentrations may be even more detrimental to biota (e.g., exposure to hydrogen sulfide, decreased resistance to disease and contaminants). Dissolved oxygen levels are highly variable over time, fluctuating widely due to tidal action, wind stress, and biological activity. In a pilot study to evaluate the best sampling strategy for DO in Gulf estuaries, continuous meters that measured DO, percent DO saturation, salinity, temperature, water depth, and pH were deployed at eight locations over a 4-month period. Monte Carlo analysis of the eight 4-month records showed that tidal influences during summer months were small and that day-night differences accounted for most of the observed variability with wind stress accounting for most event-oriented phenomena. These analyses revealed that 1, 2, or 3

random instantaneous measures of DO were likely to mis-classify a station with unacceptable DO conditions (i.e., DO <2 ppm for > 20% of time period) as acceptable at a rate of 60-70%. Furthermore, short-term continuous measures of 24, 48, and 72 hours also tended to mis-classify unacceptable sites although not as often as instantaneous DO measures (i.e., 50%). One of the objectives of this study is to collect data to best represent the DO conditions in the estuaries of the Mississippi Coast. This approach will ensure that criteria developed for our estuarine waters are the result of a carefully designed program drawing upon available resources and expertise to benefit the people of the State of Mississippi.